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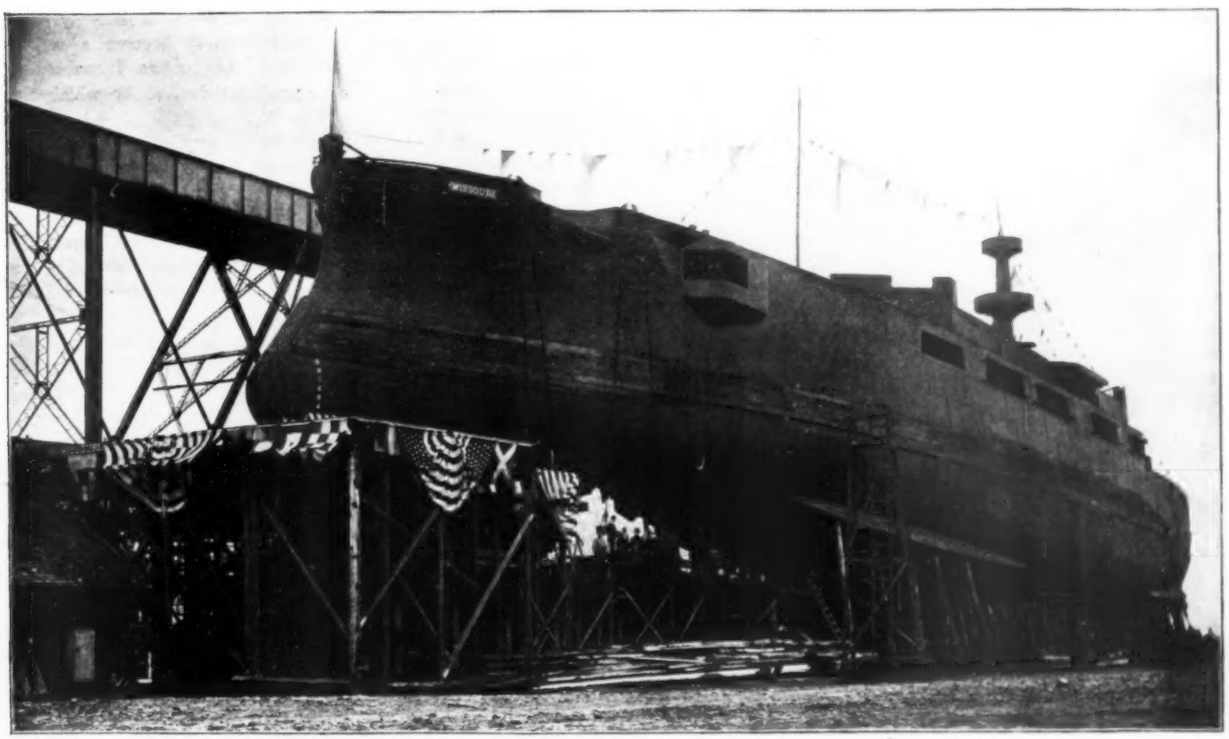
POPULAR MECHANICS

An Illustrated Weekly Review of the Mechanical Press of the World

"Tells you how to do things." Written so you can understand it.

Vol. 3. No. 3. CHICAGO, JANUARY 17, 1903. PRICE 5 CENTS

Building Warships for New American Navy



LAUNCHING OF THE BATTLESHIP MISSOURI

Important Work that is Needlessly Hampered by the Presumptuous Interference of Magisterial Naval Constructors

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Overwise Officials Delay Battleship Building.
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Modern Tools Built the Pyramids.
Essay on Popular Mechanics Rated Best.
Building Railroads in the Far West.
Walking the Tight Rope on a Fastly Moving Automobile.

JAN 23 1903

OVERWISE OFFICIALS DELAY BATTLESHIP BUILDING.

Superabundance of Geniuses, Red Tape and Aggravating Interferences Impede Important Work.

Editor's note: The front page picture of the Battleship Missouri is given as an illustration of one of the most important stages in the construction of a great American battleship. A glance at the picture will convince the observing mechanic of the enormous amount of work in such a vessel and of the great length of time that would be required to build it even without the aggravating and unnecessary delays explained in the following article by Mr. Dickie. The picture shows the Missouri ready for launching in the Newport News Ship Building & Dry Dock Co's yards. The Missouri is a battleship of 16,000 horse-power, 12,500 tons displacement and has a speed of 18 knots. She was built at a cost of $2,885,000. She has four 12-inch breach loading guns; sixteen 6-inch rapid fire guns; six 3-inch, twelve 3-pounders, two 3-inch rapid fire guns; two field guns, 6 automatic and two machine guns.

By George W. Dickie, Esq.

No other government can boast of a finer staff of competent naval constructors and marine engineers in charge of new work under construction for its navy than the United States Navy department. In fact, the ability of the superintending naval constructor or senior inspector of machinery is often quite embarrassing to the simple shipbuilder. One of the most important causes of delay in the construction of naval vessels is the habit which has hitherto prevailed of designing such vessels while they are under construction. The shipbuilder would like to carry out his work just as he thought it would be carried out when he made his estimate of cost, but between him and that honest purpose of his there stand the superintending constructor and his numerous assistants, and after them the bureau they represent. Plans are made only to be returned over and over again as unsatisfactory, and what seemed plain enough to the simple-hearted shipbuilder when making his estimate, becomes now so complicated that the first year's time of the contract is lost in finding a way to carry out the contract.

There should only be one naval architect responsible for the design of the vessel outside of her propelling machinery. Now we have three parties trying to do the work. The bureau of construction and repair, the superintending constructor, and the shipbuilder, and much time is lost in trying to harmonize the ideas of these three parties to the design.

Why should steel material that is under no stress, and cannot possibly be brought under any, be tested just as carefully and rigidly as material that of necessity is always under severe strains? We have seen chocks and distance pieces, for which cast-iron would be just as good as any other material, rejected, and the work delayed, until other material was obtained that would meet say a high tensile test, when its function in the structure was simply to stand a little compression. We feel sure that in regard to such questions the constructor at a Navy Yard, where a warship is being built, will be obliged to use a good deal more common sense than he thought necessary to fulfill his duties at a private yard.

We have often seen work being prosecuted to reach a certain result in the construction of a naval vessel stopped, because the naval construcor desired to consider the possibility of reaching the same result in another, and perhaps more direct way. There may have been twenty ways by which the same result could have been reached, and work may be stopped for six weeks while the superintending constructor is in search of the shortest way, and yet by the longest of all the twenty ways the work might be done in a week. This is no fancied condition existing only in the mind of the writer; it is the normal condition under which construction work is carried on at a private yard, on naval vessels, and it is one of the most serious causes of delay that the builder has to contend with, and the most difficult one to make claim in regard to, as the intention of the naval constructor is to help and not to hinder the work.

Popular Mechanics "Tells You How to Do Things."

SYNTHETIC ALCOHOL NOT COMMERCIALLY DANGEROUS.

Difficulties of Producing It From Acetylene Makes It an Unimportant Competitor.

By Prof. M. T. Bogert, of the Department of Chemistry, Columbia University.

Producers of alcohol, very probably, have no cause for alarm over the report from France that alcohol is being made from acetylene. I do not think that there is any danger of synthetic alcohol becoming commercially dangerous in France or anywhere else. The process of producing alcohol from acetylene is an old one. It depends upon the production of ethylene from acetylene and the subsequent conversion of the ethylene to ethyl sulphuric acid, which yields alcohol when distilled with steam. The difficulty has always been in the first step of the process—that is, in the conversion of acetylene to ethylene. If a large yield of ethylene could be obtained readily and cheaply from acetylene, synthetic alcohol would possibly become a serious competitor of fermentation alchol. As far as I am aware, however, no processes have as yet been devised by which this can be accomplished.

Many patents for the production of synthetic alcohol have been taken out both here and abroad, but as far as I know no one of them has ever proved a success or has been commercially feasible. I do not think that the product has ever been put on the market. Experiments carried on in the chemical laboratories of Columbia have shown to me the difficulty of obtaining the article economically. Synthetic alcohol is known to the chemist as ethyl alcohol. It differs from the ordinary fermentation alcohol in that it is purer and also is a chemical individual. Ordinary alcohol contains a great deal of ethyl alcohol, but is also likely to contain small amounts of aldehyde, acetalæ, fusel oil, etc. The difference between the two may well be likened to that existing between synthetic indigo and the natural product.

WHY HEADACHE POWDERS ARE DEADLY.

The deaths among women caused by taking patent headache powders mentioned in Popular Mechanics recently has been the subject of considerable comment. Most of the fatalities, it is believed, are people with weak hearts. Practically every one of the headache powders on the market has been found on analysis to contain acetanilid, or some other coal tar product similarly affecting the heart. The drug costs but 30 cents a pound and from five to fifteen grains is considered a fair dose. But even a five-grain dose may be deadly, doctors say, to a person with severe heart trouble. The drug's action on the human system is to lower the blood pressure, which is usually the cause of headache. An overdose paralyzes the heart, when it is dilated, and causes death. It is the sudden lowering of the blood pressure that causes the lips and finger nails to turn blue.

Some of the more costly headache cures contain some kind of heart stimulant to counteract the deadly effect of this drug; but the stimulant may be nearly as dangerous as the acetanilid. Some contain cafein with bicarbonate of soda and some contain strychnine. Nearly every druggist has on sale a headache powder of his own invention and in many instances the chief ingredient is a coal tar product with no protection for the heart. These are the ones classed by doctors as "deadly."

Prof. Wood of Johns Hopkins University has made a screen which does not admit heat rays and bars all light except the ultra violet. For thirty years scientists have sought such a screen.

Last year Cuba produced 850,000 tons of sugar; the United States, 425,000 tons; Hawaii, 340,000 tons; Java, 725,000 tons, and Brazil, 205,000 tons.

CABLE LINKS HAWAII TO THE MODERN WORLD

First Message Across the Pacific--Section to Manila Rapidly Nearing Completion

By George G. Ward, Vice-President and General Manager of the Commercial Pacific Cable Company.

The cable to Hawaii was connected through to San Francisco at 8:45 p. m. Jan. 1, Honolulu time. The cable opened for public business Monday, Jan. 5.

Rapid progress is being made in the manufacture of the section to be laid between Honolulu and Manila. More than 3,500 miles of this cable has already been manufactured. I fully expect messages will be exchanged with Manila by July 4 next. The laying of the remaining sections will commence from Manila the first week in May next.

The first official cablegram from Honolulu was received at the White House at 2:30 o'clock a. m., Jan. 2. It was dated Honolulu Jan. 1, 9:33 p. m. Following is the exact wording of the message:

"The President, Washington: The people of the territory of Hawaii send their greetings to you and express their grati fication at the inauguration of telegraphic communication with the mainland. We all believe that the removal of the disadvantage of isolation will prove the strong factor in the upbuilding of a patriotic and progressive American commonwealth in these islands. 'Henry F. Cooper,

"Secretary of Hawaii."

The President's response was as follows:

"White House, Washington, Jan. 2, 1903.—Henry F. Cooper, secretary of Hawaii, Honolulu, Hawaii: The President sends through you to Gov. Dole and the people of Hawaii his hearty congratulations upon the opening of the cable. He believes that it will tend to knit the people of Hawaii more closely than ever to their fellow citizens of the mainland and will be for the great advantage of all our people. George Cortelyou,

"Secretary to the President."

When the cable was hauled to shore in Honolulu Mrs. Hawes laid a wreath on the end of the magic line that is to connect Hawaii with the rest of the world. A great throng were assembled and the most intense enthusiasm was manifested.

The cable was stretched across the Pacific from San Francisco to Honolulu by the cable steamer Silverton, which passed through almost a continuous hurricane from the time it sailed from San Francisco, Dec. 14, until it anchored in Molokai channel, 35 miles from Honolulu, Dec. 26. Even then five days of storm and heavy seas delayed the completion of the work.

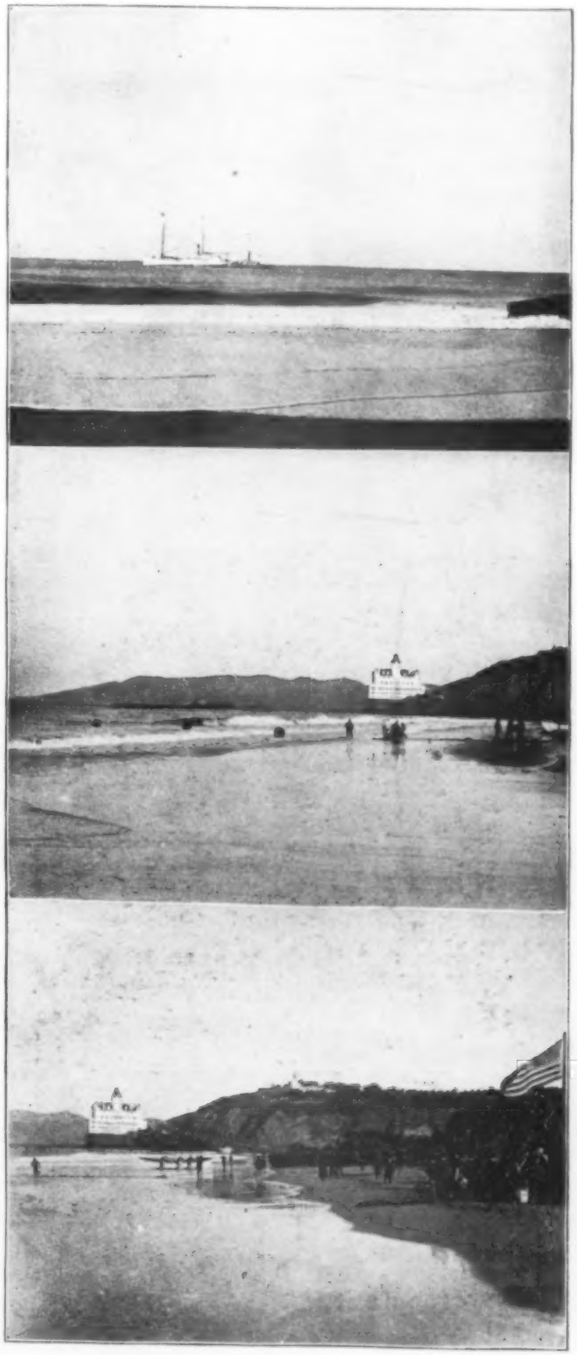
The start of the Silverton from San Francisco was made under most favorable circumstances. A more perfect day could scarcely have been imagined than Sunday, Dec. 14, when the shore end was laid near the Cliff house, off San Francisco. The line of the shore end was brought on board the steamer at 5:30 in the evening and the start was made Monday morning. A few hours later the terrific weather began, which continued throughout the trip to Honolulu.

The business of the fifty largest postoffices in the United States, which furnish more than half the revenue of the department, shows an increase of 20 per cent over the previous year. The number of offices is increasing more than 1,000 a year.

In our recent issue describing the new Chicago postoffice, the amount of steel used in the structure was given as 11,000,000 tons. This, of course, should have been 11,000,000 pounds.

But one person in eighty of the workers of London goes to church.

The accompanying pictures were taken by Fred J. Travis, of 2021 Bush St., San Francisco. Mr. Travis says: Considering the difficulties the pictures are good. Fig. 1 shows the steam schooner Newsboy and the tug boat Sea Queen, which assisted in the work of laying the shore end of the Pacific and Honolulu cable. Between the two boats may be noticed a small spot which has the appearance of a black ball. It is an inflated buoy which has the shore end of the cable. The Cable Steamer Silverton could not safely come within six



miles of shore to do any work. So the steam schooner brought six miles of cable within three-fourths of a mile of shore. No. 2 shows the men at work taking off the first buoy of the cable. The large white building is the Cliff House. The high mountain peak in the extreme background is Mount Tamelpais. Fig. 3 shows the cable on shore. Mr. Mackay and other officials of the cable company are about to take hold. The famous Golden Gate Life Saving Crew with its boat G. G., is also shown. The large house on the hill to the right of the Cliff House is the residence of the late Adolph Sutro, known as Sutro Heights.

TO DETERMINE PRESSURE ON AUTOMOBILE TIRES.

By Herbert P. Kelly, Engineering Department Brown & Sharpe Mfg. Co., Providence, R. I.

Referring to your article of Dec. 27, page 806, quoted from a foreign authority, on fitting an auto with pneumatic tires, the writer seems to have been working under a misapprehension of the principles involved in his directions for ascertaining the pressure on tires due to loading of the vehicle. It is only necessary in weighing the pressure on front wheels that they bear entirely on the scale platform, that the rear wheels do not at all, and that the load be distributed exactly as in service. It matters not where the edge of the platform comes. Likewise in taking a reading for pressure on rear wheels they must bear fairly upon the platform, anywhere so that the front wheels do not. Then if the wheel base is exactly level and the scale is accurately calibrated, the sum of the two readings will exactly equal that given by the entire vehicle. Neither of these tests will, however, give the maximum load in the respective cases on the tires. To get this, the wheels off the scales must in each case be blocked up to equal the steepest grade the vehicle is expected to encounter and a scale reading so taken, with load adjusted as before.

LIGHT HOUSE IN THE DESERT.

There is at least one lighthouse in the world that is not placed on any mariner's chart. It is away out on the Arizona desert and marks the spot where a well supplies pure, fresh water to travelers. It is the only place where water may be had for forty-five miles to the eastward, and for at least thirty miles in any other direction. The "house" consists of a tall cottonwood pole, to the top of which a lantern is hoisted every night. The light can be seen for miles across the plain in every direction.

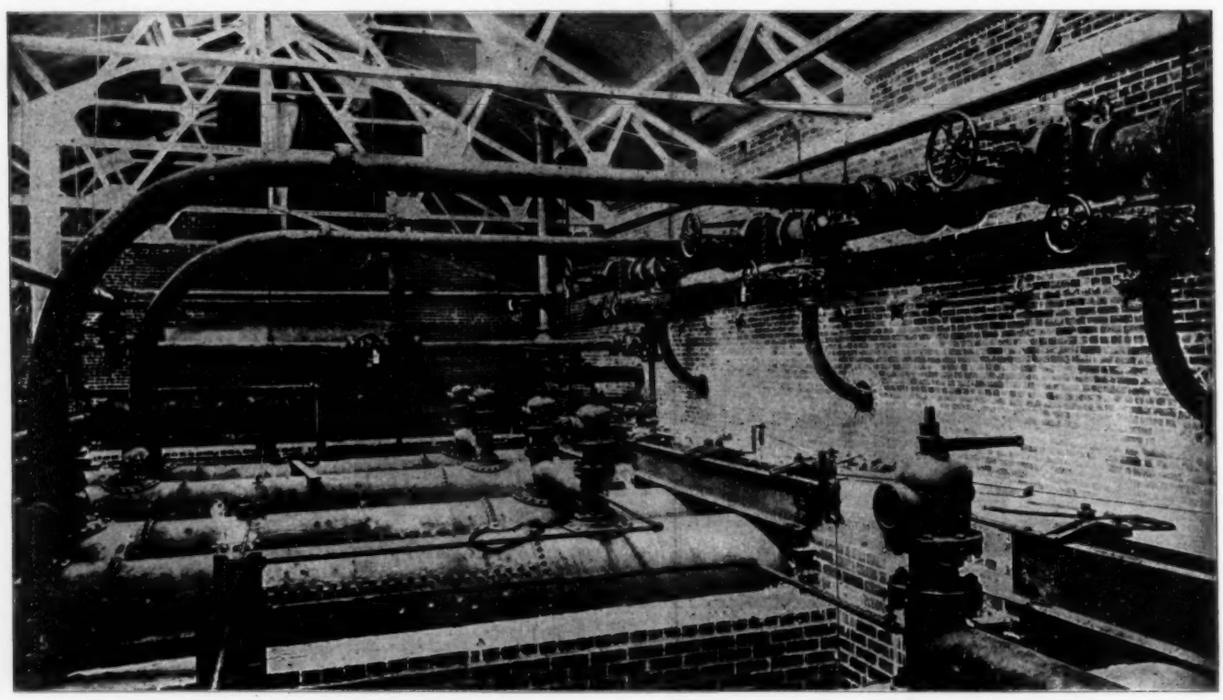
An English furniture dealer is reported as saying: "I regret to say, as a patriotic Englishman, that 90 per cent of the office furniture we sell is American."

ELECTRIC RAILWAY SERIES, PART II.—THE BOILERS.

Great Seething Caldrons, Where Lakes of Water Are Converted into Steam.

It is not much of a power house in these days which does not cost $100,000; most of them several times this sum, and not a few a million dollars or more. The building does not cost so very much as a rule, but the machinery is very expensive, while thousands of dollars are spent on work which the visitor never sees at all. For instance, the foundations for the smokestack, boilers, engines and generators must be as solid as a rock, and not only be able to support hundreds of tons of weight, but do it without a jar or tremble when the engines are working at thousands of horse-power. The first illustration is looking down upon a battery of boilers during construction, and before the boilers and steam pipes were covered to retain the heat. From the left spring immense pipes for conducting the steam to the mains, from which it will pass into other pipes, through the brick wall to the engines in the adjoining room. In the lower right hand corner may be seen a safety valve already in position, but on which the weight has not yet been fixed. The wheels on the pipes are for opening and closing the valves which control the passage of the steam, and are so arranged that steam can be taken from any or all the boilers and flow to any one or more of the engines. This permits the cleaning or repair of one boiler while the others are in use.

On the opposite page is shown a portion of the boiler room in another plant, completed and in operation. It will be noticed the boilers are neatly covered and all the steam pipes have been covered so that the least possible amount of heat may escape. An elevated walk has been suspended from the roof to enable the men to have ready access to the valves. At the peak of the roof are ventilators for the escape of hot air. The steam fittings of a plant, which include the pipes, valves, etc., are very expensive, both in cost of material and the labor to install them. Many a plant has cost thousands of dollars more than was necessary, simply because the man who made the plans blundered or did not know. The work illustrated is of a high order, and was installed by Westinghouse, Church, Kerr & Co.



Interior of Boiler Room Above Boilers During Construction.

TO SEND MAIL BY WIRE.

Letters and Packages as Well as Telegrams May Be Dispatched By Electricity.

"The electric post," by which letters and packages may be sent, is the invention of Signor Piscelli of Italy, and is now being tested in England. The London Leader says:

The electric post is a means of dispatching letters in which all the stages through which letters have to pass between the time they are posted and the time they are delivered to the postman are performed mechanically. The forwarding of the letters is effected by means of small vehicles worked by independent electric auto-motors running over special aerial lines. These lines would run principally along railway and road transports, and in addition to connecting the towns served by the system will, on reaching a large center, have several ramifications uniting both the posting boxes and the branch offices situated in various districts of the city.

Such branch lines will be for the collection and distribution of the correspondence. In this way letters will, it is claimed, be forwarded at phenomenal speed.

BLIND MAN BUILDS WALKS AND DIGS WELLS.

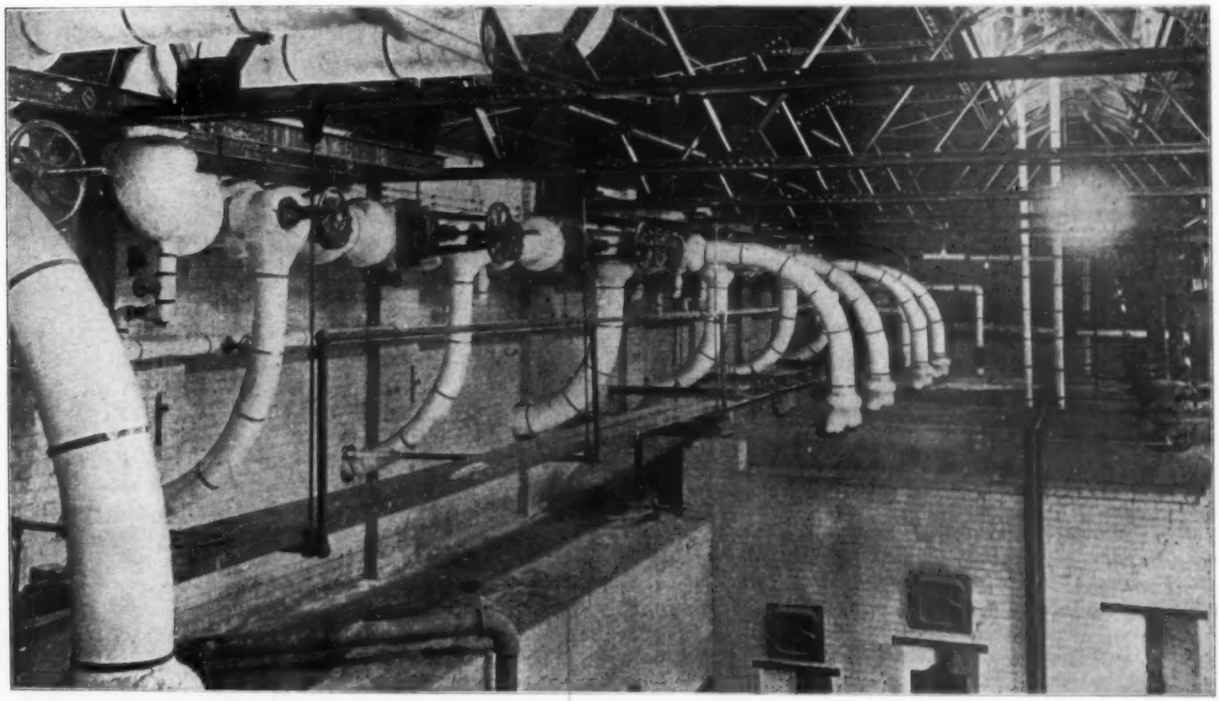
George Carter, of Nunda, N. Y., is totally blind. He is 55 years old, yet up to the time of a recent injury he cleaned wells, shingled houses, split wood, built sidewalks, did all manner of farm work, and took walks through the country varying from three to eight miles. Frequently Mr. Carter has been seen coming back at night time leading a cow which he had brought with him from the farm. "I know the turns by the lay of the ground," he says. "Then, too, the wind helps me, carrying to my ears the sound of railroad trains, farm bells and all the familiar noises of country life." Mr. Carter can lay a sidewalk as straight as any man who has perfect possession of his sight. He is a carpenter as well as a farmer.

YERKES TELLS OF LONDON UNDERGROUND.

Says American Labor Is More Intelligent and Has Better Leaders Than English.

By Charles T. Yerkes, of Chicago, who is building the great new underground system of railroads in the city of London, and who is now in the United States on a visit.

The new London underground system which will connect with the Metropolitan district system, penetrating the heart of London, is composed of four roads—the Baker street and Waterloo; Charing Cross, Euston and Hempstead; Brompton and Piccadilly, and the Great Western and Strand. The Baker street and Waterloo will be completed in about fourteen months. The four tubes will have a total mileage of 50, which added to the 48 miles of the Metropolitan district, gives a grand total of 98 miles.



Interior of Boiler Room—Completed.

Four years will be required to finish four tubes, and fifteen months to equip the Metropolitan district with electricity. The tubes will range in depth from 20 to 100 feet below the surface.

Concerning union labor, I wish to state that in America the labor union is greatly superior to the unions of Great Britain, being conducted on a more intelligent basis and being led by able leaders.

In England the rule is to keep the brilliant mechanic down to the level of his less favored brother, while over here no such restrictions are imposed. I do not care to say anything against the leaders of organized labor in England, but I will say that I consider John Mitchell a brilliant man, who handled with great tact and diplomacy a delicate situation.

American unions as a whole are composed of intelligent men, who are getting more and more intelligent every day, and the result is that the day is coming when there will be a perfect understanding between labor and capital in the United States, for the simple reason that the intelligence of labor will demand it.

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Published by Popular Mechanics Co.
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IS A WOMAN'S INVENTION.

Breadmaking Machine Wins Fifty-Dollar Prize Offered by Boston Club.

The offer of a $50 prize made by the Women's Educational and Industrial union of Boston, for the best household labor saving device invented by a woman, brought out many useful and ingenious conceptions of feminine minds. The $50 prize was awarded to the breadmaking machine invented by Mrs. Lydia Coale Sharpless of Philadelphia. The device mixes the bread quickly and thoroughly by machinery, thus avoiding the unpleasant hand manipulation and kneading. Considering what too many bakeries lack in the item of cleanliness this abolishing of the hand mixing is, in itself, enough to immortalize Mrs. Sharpless' invention. Besides, however, the machine is said to double the digestibility of bread, as it disposes of the unburst starch cells which, in bakers' bread, are carried into the system and are very hard to digest.

The machine consists of a box or tank in the middle of which are two rollers armed with knives that fit into each other dove-tail fashion and work spirally. At the top of the tank is a perforated fan for sifting the flour through. To use the machine a sufficient quantity of warm milk and water and other needed ingredients are poured into the bottom of the tank. Then flour is put into the sieve at the top, and the rollers are set to revolving by the turning of a handle. In three minutes the bread is mixed, not packed, and it is left to rise. A thermometer at the side of the machine indicates the temperature. No more raw flour need be used when the bread is risen and is ready to be put into the pans for made thus, instead of being mixed by the kneading process, it is not sticky. There were two of the machines on exhibition. The small one made ten loaves of bread in three minutes. A large one—such as the United States government has bought for the navy—mixes 1,200 loaves in the same time.

Mrs. Sharpless is a Quaker. When she was a girl at the Friends' school in Philadelphia, her Quaker teacher, a woman, said to her: "Lilly, thee needs to think." Lilly has evidently been thinking.

HOW TO FIRE WITH SOFT COAL.

Fuel and Labor May Be Saved by the Exercise of Proper Skill.

By the Hartford Steam Boiler Inspection and Insurance Co., Hartford, Conn.

To burn bituminous coal without smoke has long been the hope of inventors and engineers, for it is generally admitted

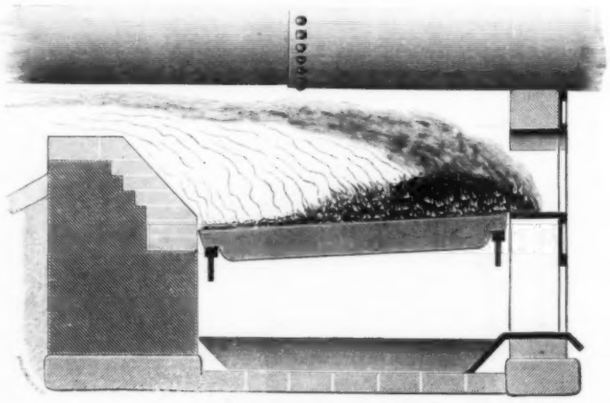


Fig. 1. Bad Firing—Side View of Furnace.

that an enormous waste occurs when any considerable amount of smoke issues from the chimney. It is true that smoke is a sure indication of imperfect combustion, but the vapor ordinarily seen coming from the chimney is not all smoke. The dense black smoke sometimes seen comes almost entirely of unconsumed carbon, but the composition of the lighter smoke is entirely different. The black smoke is usually given off when long flames of yellowish or reddish hue lap along the whole length of the boiler and perhaps pass into the flues. When the damper is right, the draft good and the fires well laid, so that all parts of the grate are evenly covered, the lazy smoke flame is changed to a short flame of intense brightness. Too much air is as capable of producing smoke as too little; for by its chilling air it makes perfect combustion impossible, and causes the same dense cloud to appear at the stack. In charging fresh coal it is a good plan to leave the furnace door ajar slightly until

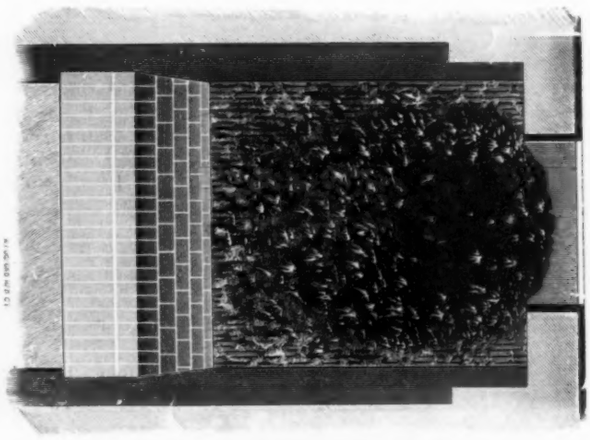


Fig. 2. Bad Firing—Plan View of Furnace.

the fire has burned up a little so as to admit an extra supply of air, that which passes up through the grate being checked for a few moments by the fresh fuel. If the door is kept wide open the boiler will be cooled down and may be severely strained; big columns of cold air will pass right over the fire in a body and right up the chimney. But if the door is kept half or three-

quarters of an inch ajar the air that is admitted will distribute itself through the furnace pretty uniformly, and will consume the gases given off by the fresh coal. As soon as the gases burn off the door again should be tightly shut.

There is good and bad firing. To fire only at considerable intervals, throwing on coal so heavily as to almost shut off the draft for a time, is certainly bad. Fires run in this way and then left to themselves burn hollow, and air rushes through the holes, burning the fuel away around the edges of them, thus constantly enlarging them until after a time a strong current of cool air passes unchecked up through the grates, along the side-walls and the bridge, and the hot gases coming from the coal are so chilled by it that it is almost impossible to make steam. The same result follows when the coal is heaped upon the center of the grate like a haycock, as shown in Figs. 1 and 2. In

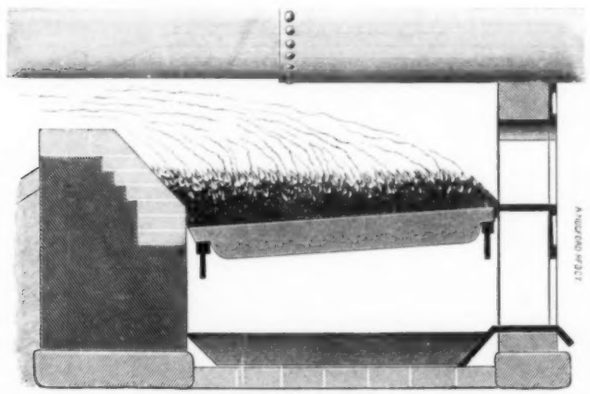


Fig. 3. A Good Fire.

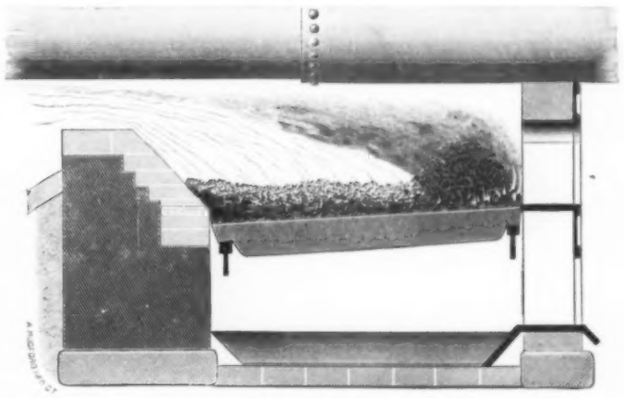


Fig. 4. Coke Firing with Soft Coal.

both these cases the invariable result is a hard-worked fireman, struggling laboriously to keep up steam and a bitter complaint from the office at the cost of the fuel consumed.

In Fig. 3 a bituminous coal fire is shown from 6 to 9 inches thick. It is kept thicker at the back end and along the furnace walls and in the corners, because the heat radiated from the side walls and the bridge causes the coal in these places to burn faster than that on the rest of the grate. It is kept solid and in form by quickly sprinkling a thin uniform layer of coal on alternating sides of the furnace at frequent intervals, and by falling in such parts as burn hollow.

Fig. 4 illustrates what is called coke firing. The grate is covered with incandescent fuel as in Fig. 3, except near the doors where a windrow 18 inches wide and built of fresh coal extends entirely across the front of the furnace. The heat to which this windrow is exposed causes it to coke as it would in a retort in a gas works, and to give off the inflammable gases that it contains, which are burned as they pass back over the incandescent bed of fuel. When fresh air is required this mass of coke is broken up and distributed evenly over the grate, bearing in mind the necessity of keeping a good supply on those portions of the fire which tend to burn the fastest. When the fire has again become incandescent, fresh coal is put to coke, and so the firing continues. In this method of running a fire it is still all-important to prevent holes from burning through, and admitting undue quantities of air into the furnace.

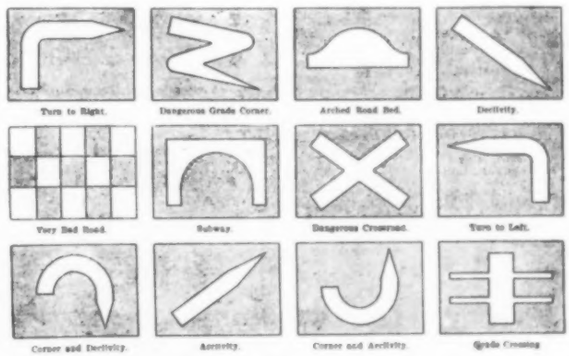
The locomotive famine is now so severe that railway companies are glad to pay largely for the privilege of getting an order into the shops. President Loree speaks of it as great good fortune that he was able to buy out another company's space in the Baldwin shops for seven engines by paying a premium of $7,000. Money cannot buy locomotives now, he says, and no man can get one built before January, 1904, unless the order is already in.

ALPHABET ON A PIN HEAD.

R. H. M. Jantzen, a Pittsburgh engraver, has engraved the alphabet and eight other letters, making thirty-four in all, upon the head of an ordinary pin. The pin head has on it the alphabet, 1902, and R. H. M. J., the engraver's initials. Three-quarters of an hour was required to complete the task. Mr. Jantzen worked with the pin clamped down to a table and with a small microscope to his right eye. Each letter is so distinct that it can almost be seen with the naked eye.

PICTORIAL ROAD SIGNS IN FRANCE.

In order to establish a system of road signs which would be plain and universally understood, the Association Generale Automobile of Paris promoted a competition for schemes of the kind. The system proposed by M. Morel was awarded first prize, and has been adopted. Five hundred of the new-style boards will be posted in France before spring at the most dangerous and puzzling road points, says the Motor Age. The subscription to cover the cost is made by selling the boards. That is, the subscriber agrees to pay for a certain number at



Road Signs to Guide Automobilists.

25 francs each and his name is then painted on that number of signs.

The illustration shows clearly the system employed, and the easily memorized key for deciphering the signs, it being evident that without the caption the pictorial character of the board indicates the meaning.

For pasting paper to iron or steel, mix Dexterine with water and boil down until it assumes about the consistency of very thin glue. It will not hold on oily substances.

About 2,000,000 of London's inhabitants get no medical treatment save that of charity dispensaries or hospitals, and one of every four of them, it is said, goes to bed hungry every night

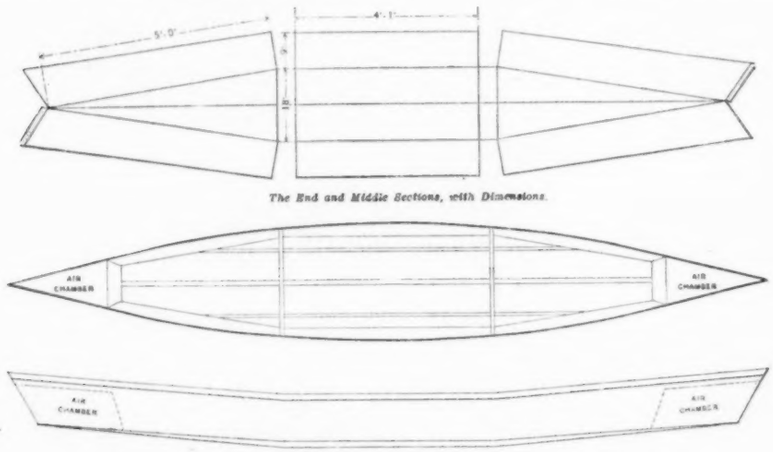
How to Build a Sheet Metal Boat--Part I

Just the Thing for Hunting and Fishing and Will Last for More than a Decade

Editor's Note—For shooting and fishing nothing in the boat line is so serviceable and substantial as the sheet metal boat. With a little mechanical ingenuity and small expense you may build such a boat for yourself from the following suggestions in a Metal Worker article by Martin L. Kaiser:

By Martin L. Kaiser.

Herewith is described a sheet metal boat which has been in service for 13 years. For 10 years it was used with single and double bladed paddles, as the boat easily carries two persons. In addition to this method of propulsion it is now used with the feathering spoon oars and roller seat, the equipment for which is attached to a board that can be readily placed in position for either one or two passengers. The comparatively flat bottom and slightly upturned prows have much to commend the boat for use in shallow waters and marshy places, while the entire absence of a keel is compensated for by the fact that, when loaded, both prows extend far enough under water to act in that capacity. It is, of course, understood that in boats of such narrowness of beam and low freeboard the occupants should sit almost or quite on the bottom of the boat, when it will be found that the center of gravity will be not much above the load water line.



The End and Middle Sections, with Dimensions.

Figs. 1, 2 and 3, Respectively, Showing Plan and Side Elevation of Boat.

The boat is composed of three sections, two end sections and a middle section, made of No. 26 galvanized sheet steel, 36 inches wide, and of the shape and dimensions given in Fig. 1. A plan of the boat, showing the boards for protecting the bottom and giving the side elevation, is presented in Fig. 2.

The middle piece or section is made from a piece of galvanized steel, 36 inches wide and 4 feet 1 inch long, formed into a trough of the dimensions and shape shown in Fig. 3. Two pieces of the same material, each 5 feet long, and cut as shown in Fig. 1 are formed up so that the large ends will present the same profile as the trough previously formed, while the small ends should be riveted together, so as to form sharp prows, as shown in Fig. 2. To do this, the longer end of the side pieces may be doubled back over the shorter end and riveted and soldered; or a stiffening piece of heavier material may be inserted and riveted together with the sides. The air chamber covers should now be riveted and soldered in each end, as the parts may at this stage be more readily turned and handled. Each air chamber cover should be about 20 inches long, and the top of the cover should be 1½ inches lower than the top of the sides of the boat, so that the wood rail may extend the full length of the finished boat.

The two end parts should now be carefully lined up to the middle part, and a block of wood about 2 inches thick placed under the point of each prow. When the parts are in place and true to plumb, level and chalk line, they should be tacked together with solder, and then strongly riveted with ¼-pound tinned rivets, spaced ⅜ inch apart, and the seam thoroughly soaked with solder on both sides.

(To be continued.)

POPULAR MECHANICS AN EDUCATION.

"Popular Mechnics is great. There is better matter for thought and study than can be gained in the best schools."—E. W. Potter, 175 William Street, Rochester, N. Y.

A Frenchman is said to have invented a phonetic typewriter which can be operated at the rate of 200 words a minute.

To reduce the size of a cork, cut a wedge out of it.

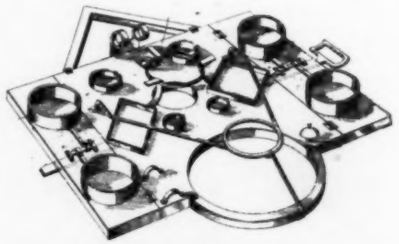
REMARKABLE WORK OF A TELEPHONE.

The illustration herewith shows the telephone which is doing splendid service on a big Iowa farm which is located on the Mississippi river. The owner has another farm twenty-eight miles away, and to connect the two he purchased a pair of these telephones, and uses a barbed wire fence for a telephone line, the wire being insulated from the posts. As the phones are very inexpensive, the manufacturer did not promise that they would work over a line more than twenty-five miles, but they did. The telephone is made by C. A. Turnquist, 442 West Van Buren street, Chicago, and is known as the "Private Line" telephone.

'Phone that Talks Over Barbed Wire Fences.

SERVING TRAY—A WOMAN'S IDEA.

A serving tray for use by waiters on dining cars and steamships, where the dishes have a tendency to slide suddenly to the floor, has been invented by a Philadelphia woman. The cut shows the arrangement for holding the cups and other table utensils in place while being served.



Serving Tray.

A new form of moonstone, having crystals of red graphite, which in some positions give it the appearance of sun stone, has been discovered in North Carolina.

The next Ziegler expedition to the pole will be headed by Antony Fiala.

TO PLOW A FURROW 1,500 MILES LONG.

The French government proposes to plow a furrow 2½ feet deep and 1,500 miles long across the North African desert from Tunis to Lake Chad, to contain a telephone cable. The enormous plow will be drawn by an engine at the rate of only a mile an hour. It is claimed that this system will prove wonderfully satisfactory and will cost little more than to string them on poles.

A Frenchman claims to have discovered a process for the reduction of wood to a molten condition.

SPLENDID WORLD'S FAIR BUILDING.

With its elegant statuary, colonnade and pavilions there will be no more beautiful structure at the St. Louis World's Fair than the Textiles building. It is to occupy 525 feet on the main thoroughfare of the exposition and this and the Electricity are the only two buildings facing the Grand Basins with the cascades and approaches to the terrace crowning the hill on which the art building stands.

The judiciary of Canada has decided that the term "pig iron" includes hot as well as cold metal.

ELECTRICITY OBTAINED FROM SUN'S RAYS.

According to the Secolo, a publication of Milan, Italy, a machine that converts the sun's light and heat into an alternating electric current has been invented by Sig. Pansa, an engineer of Cassino. The inventor is quoted as saying that everybody by the use of this machine will soon be able to manufacture his own electric power, light and heat.

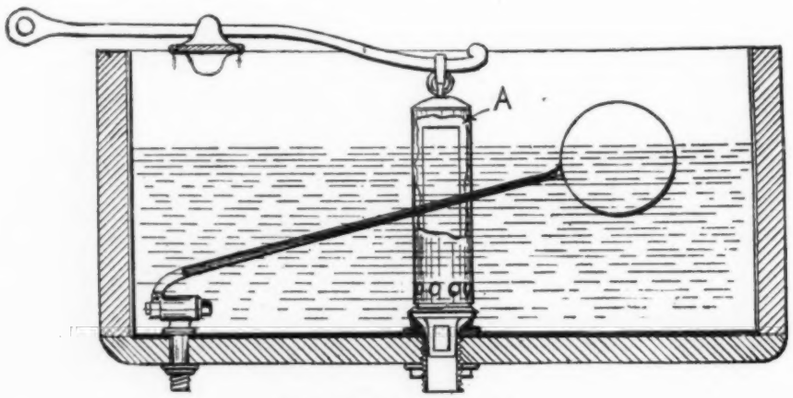
Grand Rapids, Mich., has a co-operative telephone company in which the cost to the subscriber is only 25 cents a month.

SHOP NOTES

REPAIRING CLOSET CISTERNS OR FLUSH TANKS.

Closet cisterns of cast iron, painted, galvanized or enameled have these advantages: They are seamless, therefore less likely to leak; no lining is necessary and they have no glue or nails to give out, says a writer in the Metal Worker.

As a drawback, they are heavy, not very handsome in appearance, and in warm weather are apt to sweat a good deal. Earthenware cisterns are open to the same objections and are also easily fractured. The wood cistern, if well put together and well lined, is about as durable as any. The race for cheapness has resulted in a grade that depends too much on glue, with few nails or clamps, a lining of paper weight, copper or zinc, with fittings of a nonendurable character. After being in use for a while the woodwork falls to pieces, the seams give way and trouble never ceases.



Simplest Style of Cistern Siphon.

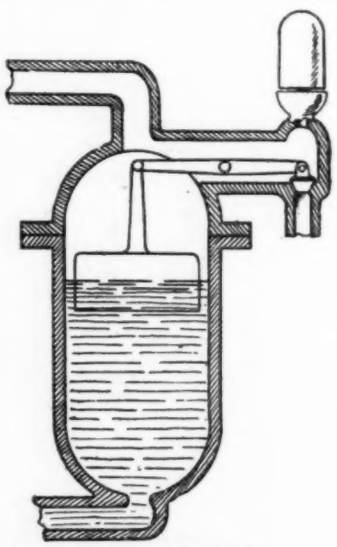
When you are sent to remedy such a trouble don't decide at once that a new ball cock is what is wanted, but get up and make sure of the real trouble. See if the water line is such that it stands above the overflow tube inside of the siphon, if the construction be something similar to that presented in the illustration. If the float be submerged, or nearly so, raise it for a moment and dump the cistern. You may then find the float partly filled with water, the weight of which holds down the lever. If the water feeds in through the ball cock when the lever is held up tight, you will see at once that the washer or the seat needs renewal. Sometimes all that is necessary is to lower the float in order to bring the water line below the point A. If water still runs through the bowl, the siphon valve is leaking and needs a new rubber, or if the seat is worn the best thing to do will be to put in a new siphon valve. Sometimes, after having done all these, there is still a leak. If so, you may notice that in tightening in the ball cock the last twist of the washer nut caused the ball cock to turn slightly, making the lever (when the cistern is nearly full) to swing over against the siphon valve, prying it slightly off its seat, just enough to make a leak. Sometimes the dump lever, being out of alignment, will tilt over the siphon valve slightly. In a case when all these investigations had failed, the siphon valve was taken apart and a small hole found half way down the overflow tube inside of the siphon. Of course, the style shown in the sketch is about the simplest kind of a cistern siphon, the feature of the siphon being the steadiness of the flush, a momentary retention of the pull being sufficient to discharge all the contents of the cistern with the same head, as practically all must pass over the top of the overflow tube. It is more or less noisy, however, due to the rush of air to break the siphon.

Now and again one has a ball cock to fix that threatens to tear down the house with the hideous noise made. You may put on all the air chambers you like, but an examination will invariably reveal the fact that some part or other is loose and vibrates between the contending forces of the incoming water and the efforts of the float to close the valve. To stop the cause, make the parts fit snugly, or replace with another that will, and you will stop the noise. These noises and others, even the friction of the water going through the pipes under high pressure, are greatly aggravated by the way in which the pipes are supported when carried along under and loosely fastened to the floor joists. They are in the best position possible to conduct a noise all over the house, the joists and flooring making a good sounding board. To avoid this, where they are supported to the joists, first tack on a piece of thick felt and then secure the pipes tightly so that there can be no vibration.

The holes in the bottom of closet cistern should not be within two inches of the edge, or in tightening the lock nuts the lining may be fractured. When replacing valves, provide nice, soft leather washers around them where they pass out through the wood, placing them on the inside, of course. And remember to keep an eye on the little things. Scrape off any old white or red lead that may be sticking around the outlets, so that the washers may have a clean contact with the lining. Attention to these little things that hardly seem worth mentioning may save you a great amount of trouble and labor and increased expense to the owner.

AUTOMOBILE WATER REGULATOR.

The accompanying sketch shows a combination water level regulator and excess steam pressure alarm in use on many steam automobiles. When the water falls below the proper level, says the Motor Age, the action of the float lever opens the small valve and allows the pump to force more water into the boiler. As soon as the proper level is regained the float closes the valve. When the steam pressure exceeds the desired limit the whistle blows, by reason of the steam pressure being sufficient to lift the valve from its seat. The same form of float is also used for a low water alarm, but instead of the valve opening being connected to the pump supply, the whistle is attached instead, so that when the float lowers the valve is opened and the whistle blown, thereby notifying the operator of the need of replenishing the water supply in the boiler.



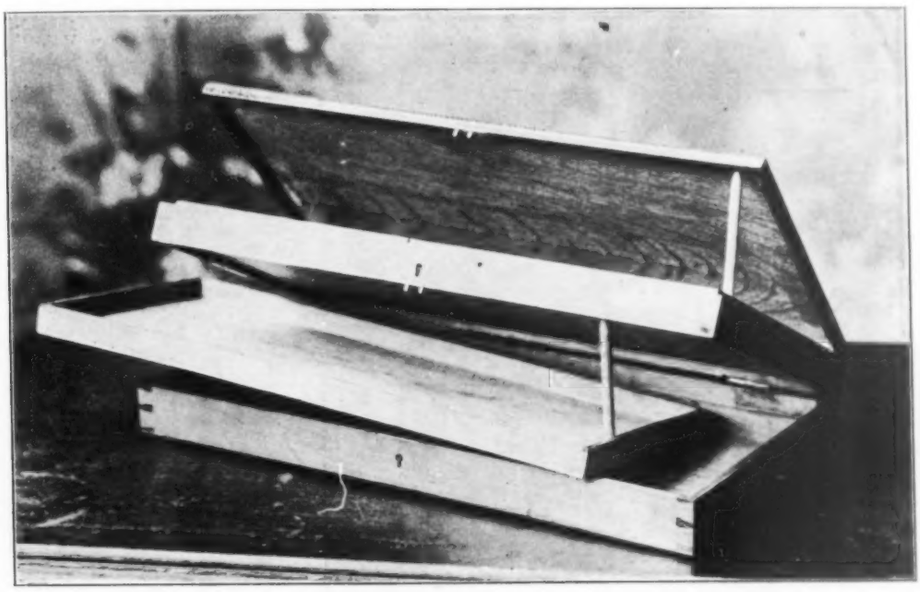
Showing the Float Lever.

One-twenty-millionth of an inch is the distance which the membrane of a telephone receiver moves in the vibration which transmits the voice.

TOOL BOX FOR DRAFTSMEN.

A very convenient tool box for draftsmen and others is described in The Draftsman by a correspondent in England, who says:

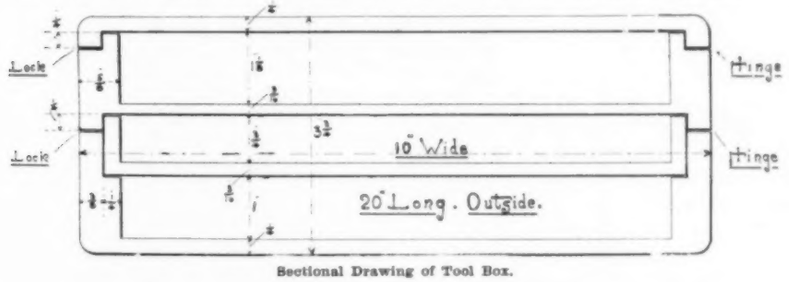
As will be seen by the sectional drawing and photograph, there is a bottom box and tray the same as in an ordinary instrument case. Now instead of a lid coming over these like the ordinary case, I put another box with the bottom made the same as the lid would be, and the top the same as the bottom box and tray combined. This makes the second box and the lid for the first box and tray. This second box is hinged at the back and locked at the front to the first box. Now over this second box I put an ordinary lid hinged at the back and locked at the front.



Tool Box for Draftsmen.

The bottom, or first box, is used for the same purpose as any other; that is, for loose tackle such as protractors, scales, etc.; and the tray and second box are finished with wood cut out and covered with velvet, for the instruments to lie in. Now for the idea of the box. If I get more tools than the case will hold, I take off the top lid, put another box like the second in its place and then put back the lid on top, leaving the case looking as if it was made like that originally. In this way, by putting one or two boxes together, the case will hold two or three times as many tools as it was made for at first, and you can always get to any one box by unlocking same, without disturbing the others. This box was made in solid oak and is in use now.

This box is not just for draftsmen only, but can be used by anyone having small tools or instruments. On looking at the box again I can see that the idea can be applied to the ordinary compass box now in use by draftsmen; that is, he can put a second box between the present box and lid, thus getting more room for tools.



Sectional Drawing of Tool Box.

ASBESTOS COATED RUBBER.

A new tubing described by a contemporary consists of ordinary India rubber, coated with an asbestos covering. For industrial purposes, laboratories, etc., where wear and tear are encountered, the asbestos is painted with green fireproof paint, which protects the coating from abrasion. Apart from preserving its pliability the tubing retains in a measure its longitudinal elasticity, as the asbestos sheathing is plaited, and the strands allow a certain movement. Burners with rubber tubes of this sort may be placed on stoves and other heating apparatus. The pipes with metallic spirals were originally made with the same object, but they are hard and inclined to break, and once leaky they cannot be mended.

HINTS ON COOLING A BOILER.

Never open the fire doors to cool your boiler. Close the ash-pit doors and open the smoke box doors in case you get too much steam, as opening the fire door causes too much contraction by the cold air cooling the furnace. It would be better to allow steam to blow off from the safety valve, which will not in any way injure the boiler.

VALUABLE INFORMATION.

7.92 inches make one link.
25 links make 1 rod.
16.50 feet make 1 rod.
4 rods make 1 chain.
10 chains make 1 furlong.
8 furlong make 1 mile.
320 rods make 1 mile.
5,280 feet make 1 mile.
10 square chains make 1 acre.
160 square rods make 1 acre.
640 acres make 1 square mile.
43,560 square feet make 1 acre.
60 geographical miles make 1 degree.
Gunter's chain equal to 22 yards or 100 links.
1,728 cubic inches make 1 cubic foot.
27 cubic feet make 1 cubic yard.
A section is 640 acres.
A township is 36 sections, each a square mile.
A span is 10½ inches.
A hand (horse measurement) is 4 inches.
A knot (nautical) is 6,160 feet.

How to Prepare Bordeaux Mixture

Greatest Known Blight Preventive and Insect Destroyer May Be Made at Home From These Directions

With the aid of Bordeaux mixture and a modern spraying machine there is little danger of having potato, strawberry, asparagus and other such crops blighted or ruined by destructive insects. The accompanying illustration shows an Aspenwall

Spraying Propagating Strawberry Beds with Bordeaux Mixture.

sprayer spraying Bordeaux mixture on the propagating strawberry beds of the Hoyt Plant and Seed Company, St. Paul, Minn. Here are directions for preparing Bordeaux mixture as given out by Cornell University Agricultural Experiment Station:

Into a barrel of water suspend a gunny sack or other porous bag, containing two pounds of copper sulphate for every two gallons of water in the barrel. If this is suspended near the surface of the water at night it will all be in solution by morning and ready for use. Into a water-tight box or other open receptacle place some fresh burned caustic lime, the amount to be determined somewhat by the amount of spraying to be done, but from 40 to 50 pounds of lime can be easily slaked at one time. Add sufficient water to thoroughly slake all the lime, and keep well stirred, so that the water may come in contact with all particles. This thorough stirring is important, and the lime should be carefully watched and stirred for several minutes, or otherwise it is likely to become dry and hard. After the lime is all slaked, cover it over with water and it is then ready for use, and may be kept for any length of time desired, if it is always kept covered with water. Ferrocyanide of potassium (used very satisfactorily in testing Bordeaux mixture) may be purchased from the drug store, and comes as a solid. One ounce of ferrocyanide of potassium dissolved in one ounce of water will be sufficient for testing many barrels of Bordeaux mixture. When it is desired to begin spraying, there should be provided two empty barrels. Into one barrel dip three gallons of the copper sulphate solution after it has been thoroughly stirred. This will provide the six pounds of copper sulphate, in case two pounds were dissolved per gallon of water, and will be sufficient for making one barrel, or forty-five gallons of Bordeaux mixture. Dilute the three gallons with ten or more gallons of water.

From the lime box dip from five to ten pounds of slaked lime into the empty barrel. Add water and stir thoroughly until the milk of lime is produced, after which dilute with some ten gallons more of water. Pour the milk of lime thus diluted through a sieve into the dilute copper sulphate solution. The quantity of lime to be added to the copper sulphate is to be determined by the ferrocyanide of potassium test. After adding a small amount of the milk of lime to the copper sulphate solution, add to the mixture a drop of ferrocyanide of potassium. If a brick red color is produced where the drop strikes, it indicates that more lime is needed. Continue adding the milk of lime until no reddish color will be produced when the ferrocyanide of potassium is used. A few trials will enable one to judge very accurately as to the amount of lime required. A little surplus lime will do no harm.

If Paris green is to be used it should now be added. Take four ounces of Paris green and place it in a dish and add water just sufficient to make a paste, and stir thoroughly until a homogeneous mixture is formed. Pour this paste into the mixture of lime and copper sulphate and stir vigorously.

Pour the lime and copper sulphate mixture into the spray barrel, which should have a capacity of forty-five to fifty gallons, and fill the barrel with water. If there is no agitator in connection with the pump, the mixture should be frequently stirred while being applied.

FOR PHOTOGRAPHERS:—HOW TO SENSITIZE POSTAL CARDS.

It is a common fad for Americans traveling in Europe to send back from each place visited a postal card bearing the picture of some notable feature of the city. The printing of a photograph of landscape or portrait on a postal card is less difficult than supposed, when you know how.

The following recipe, taken from "Phot. Mitteilungen," is given for the sensitizing of postal cards especially, but may be used for any kind of paper: Size the paper with a two per cent solution of arrowroot and dry. Coat with a brush in a dark room or by lamplight, with the following solution:

Pure water .....100 ccm.
Green iron ammonium citrate..20 g.
Potassium oxalate .....5 g.

Dry in the dark and print exactly as for platinum prints. Develop in this solution:

Water .....100 ccm.
Silver nitrate .....1 g.
Sodium citrate .....10 g.
Ammonia to dissolve precipitate.
Acetic acid till slightly acid.
Wash the prints slightly and dry.

THE MAN AND HIS SHOES.

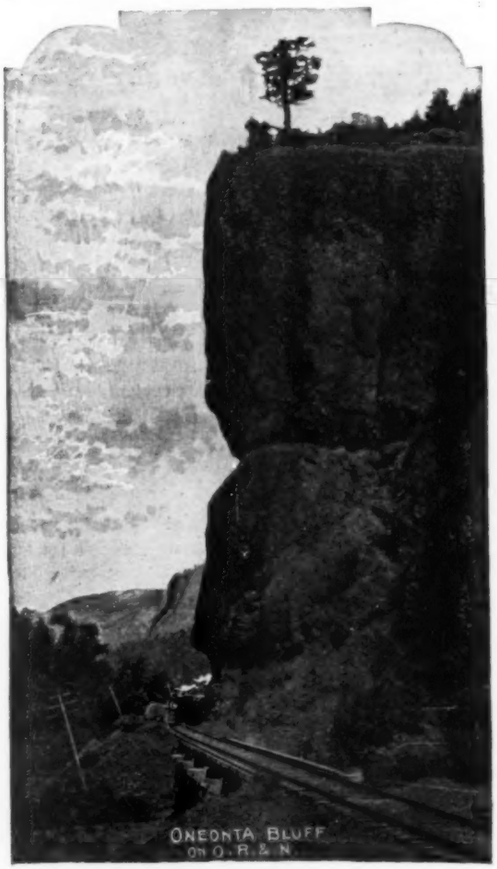
How much a man is like his shoes!
For instance, both a soul may lose,
Both need a mate to be complete,
And both are made to go on feet.
They both need heeling, oft are sold,
And both in time will turn to mold.
With shoes the last is first; with men
The first shall be the last, and when
The shoes wear out they're mended new;
When men wear out they're men dead too!
They both are trod upon, and both
Will tread on others, nothing loth.
Both have their ties, and both incline,
When polished in the world to shine,
And both peg out. Now would you choose
To be a man or be his shoes?

—Farm Machinery.

BUILDING RAILROADS IN THE FAR WEST.

Work That Is Full of Hazardous Difficulties Because of the Remarkable Country.

Building a railroad on the mountainous regions of the Pacific coast is beset with many difficulties, as may be seen from the accompanying illustration. The increase in mileage, however, would indicate that the obstacles do not greatly impede the wheels of American progress. While in the middle west and east railroads may be laid with but little grading along the great stretches of prairie, on the Pacific coast the work necessitates digging a way through great mountains, spanning surging torrents and yawning canyons, grading across deep valleys and avoiding treacherous grourds where there is danger of washouts



and landslides. In Oregon, where possibly the greatest obstacles are encountered, the railroad mileage has increased in ten years from 159 miles to nearly 2,000.

San Francisco and Portland are the termini for the numerous railroads that traverse this rugged district. The lines have become noted for their grand scenery which is said to be the most picturesque in the world.

MODERN TOOLS BUILT THE PYRAMIDS.

It is a favorite old superstition that the great pyramids of Egypt were produced by brute strength and without help from such tools as we have now. Dr. Flinders-Petrie, however, finds as a result of searches at Gizeh that the pyramid builders used both solid and tubular drills, straight and circular saws and lathe tools for working both hard and soft stone. These tools had points of some such hard material as corundum set in their ends to do the cutting—a very modern idea indeed. The work equaled in quality and rapidity any done today.

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IN ABILITY
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THE MIDGET DYNAMO OR MOTOR
Weight 3¾ pounds. Will light our 6 c. p. lamp, ring bells, explode powder. Output 10 watts. As a motor will develop 1-32 h. p. Wound for voltages 4 or 6 as desired. Other voltages up to 110 to order. *Send 2-cent stamp for illustrated* circulars.

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MECHANICAL LIBRARY FREE
It is the best work of the kind ever published and like Popular Mechanics, is "written so you can understand it." Contains 10 vols.. 4,000 pages, 2,000 illustrations. Just out. Do you want to know all about it? Then write Popular Mechanics.

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SMALL ANIMALS
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EXACT SIZE.
Your choice of the following: Horse, Buffalo, Donkey, Fox Terrier Dog, Cat, Bear, Belgian Hare, German Dachshund, Rabbit and Monkey.

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GOLD PLATED.		SILVER PLATED.	
One	20c	One	15c
Two	35c	Two	20c
Three	50c	Three	25c
Five	75c	Five	35c

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Bubier Publishing Co., Box P, Lynn, Mass.
Mention Popular Mechanics.

Essay on "Popular Mechanics" Rated Best

High School Pupils Write on Leading Magazines and Russell Parlett Wins Highest Honors

In a contest of essay writing at the Waynesville High School, Waynesville, O., the honor for the very best composition was won by Master Russell Parlett, whose subject was "Popular Mechanics." Master Parlett is in D grade. He deserves great credit for the honor he has won and for the interesting essay he composed. He is also to be congratulated for his tact in choosing an interesting subject to write on. Here is what his teacher has to say:

Editor Popular Mechanics:—The pupils of the Waynesville High School have written essays on the leading magazines of the day. I send the best one. Sample copies of your journal sent to the essayist will find a conspicuous place on our library table and will be appreciated. We thank you. Respectfully,

Mary Wilkerson, Principle.

Master Parlett's essay was rated 99½ which is considerably better than any of the other contestants. Here is the essay in full:

POPULAR MECHANICS.

By Russell C. Parlett.

Popular Mechanics is an illustrated magazine published by the Popular Mechanics Company in the Journal Building, Chicago. It is dated for Saturday of each week, although it is issued on Wednesday, preceding the day of date. It is, as its name implies, a paper published for mechanics and all persons interested in this kind of work. It gives each week condensed news of the mechanical press of the world. It is about one year old and almost from the time of its first issue it has been giving to such of its readers as are interested in electricity a series of "Easy Electrical Experiments," written by Prof. L. P. Dickinson, who is a competent authority on this subject, being professor of the electrical department of technical school. These experiments are written so that anybody can easily understand them, and under this head Prof. Dickinson has told how to make a number of articles among which are the following:

R. C. Parlett, whose Essay on Popular Mechanics Won First Prize.

Batteries (dry, storage and acid); Simple and Tangent Galvanometer; Simple Motor; a 1-20 horse-power motor; Voltmeter Induction Coil; Telegraph Instruments; Simple and Practical Telephone and a Rheostat.

Among the other writers for this paper are Prof. George W. Jones, Frank Allport, M. D., and Edwin C. Eckel, of the United States Geological Survey and many other leading scientific men of this age, who discuss various scientific subjects in a manner so simple that any one can understand them. So far as the general appearance of the paper is concerned, it is very good, indeed. It is printed on good, heavy book paper with large clear type and fine illustrations. The first page of each issue is usually given to one large picture of some great engineering feat (which is described on the second page), and the index.

The subscription price of Popular Mechanics is $2 per year. It is for sale on all news stands and sells for 5 cents per copy.

Waynesville High School,
D. Grade, No. 40.

USE GOOSE FAT FOR BUTTER.

Goose fat is used throughout Germany by the working classes as a substitute for butter, both at table and for cooking purposes. Notwithstanding the large production of geese in Germany, the native supply is so inadequate that 6,431,247 live geese were imported last year. The proportions of the trade may be inferred from the fact that one prominent dealer in Berlin is now ready to take from America, or wherever it can be produced in good marketable condition, 200,000 pounds per month from February to April of edible goose fat, at the current market price, which is now 20 cents per pound.

Live snails are used in Philadelphia to clean plate glass windows, which they do by moving over the surface of the glass and devouring all foreign matter. This leaves the glass perfectly clean. Philadelphia has been getting rather swift of late years.

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STRANGE TEST OF AN AUTOMOBILE.

Probably the most unusual test ever given an automobile is that employed by the Oldsmobile Co. It is called the test for vibration, and consists in running the newly completed machine around in circles and then suddenly up an incline with a grade of 25 per cent, which is very steep. During this trial an agile tight-rope performer stands on a tight wire such as is used in a circus. That he is able to retain his balance is considered evidence of smooth running of the machine.

Walking the Tight Rope on an Automobile Dashing Up an Incline.

SIGNAL LIGHT FOR FISH NETS.

In many of the large rivers and lakes fishing nets many hundred feet in length are set. Frequently small steamers cross the nets at night and cause great damage. To prevent this, as well as to enable the fishermen to locate their nets at night, a Portland, Ore., man has invented a signal light, which is supported on a floating buoy.

Fish Net Signals.

A drainage tunnel a mile long to cost $80,000, will be built at once and render workable a large number of mines at Cripple Creek.

I WANT TO BE A BRAKEMAN.

I want to be a brakeman,
Dog gone!
Legs hangin' over the edge of a flat car,
Train goin' 'bout twenty-five mil'n hour,
Kickin' the dog fennel 'long the track—
That's what a brakeman does.

I want to be a brakeman,
I jing!
Makin' the boys git off the platform,
Cussin' the drayman if the skids is lost,
Hollers, "Back 'er a length," and the engineer has to—
That's a brakeman for ye!

No conductor for me, just a brakeman,
By hen!
Can make a couplin' on dead run,
Has spring-bottom pants 'n' braid on his clothes,
Carries a lantern at night 'n' cap over his ears,
That's a brakeman, I'll tell ye!

I want to be a brakeman,
Geeminently!
Stand in with the agents and op'rators,
Gits to Peru every night 'n' sees the show,
Knows the numbers of the trains, chaws terbacker—
He's a regular one, you bet!

'N' I want to be a head brakeman,
Gol-lee!
Twistin' 'er hard, smoke rollin' round ye,
Country people stoppin' work to look,
Girls wavin' at ye all the way to Peru;
I'll be one, too, some day.

—The Chicago Record.

New York is now the financial center of the world, the bank clearings and stock transactions of that city exceeding London's.

Prof. Edmond S. Meany of the Smithsonian Institute is the first scientist to visit the mummy caves of the Aleuts of Alaska.

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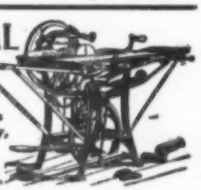

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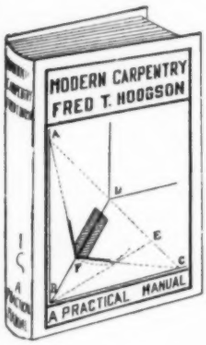

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